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OPEN SOURCE LOCATION
INTELLIGENCE AND
PERFORMANCE ANALYSIS:
A SUCCESS STORY IN AIR
TRAFFIC MONITORING

HOW THE LATEST
LOCATION-BASED
MODELING PUTS YOU IN
COMPLETE CONTROL FOR
SITE SUCCESS

IF ONLY YOUR ROAD
COULD TALK

OPEN SOURCE LOCATION INTELLIGENCE AND PERFORMANCE ANALYSIS: A SUCCESS STORY IN AIR TRAFFIC MONITORING

Easy and intuitive interface, as well as meta-models and profiling, makes Knowage a modern BI solution.

by Emanuele Ristatore & Elena Marchisa



Knowage suite provides different products, each one focused on a specific domain but mutually combinable to build a tailored product for your each analytical scope.

2018 Scenario

Currently, every company or organization access to a large amount of data, coming both from its own activities and from external sources and the capability to exploit these data is a crucial business driver. Data need to be collected, organized and made available in an efficient and effective way, optimizing available resources and making analysis understandable and easily accessible by different users within the company or organization. Among all data, according to Gartner's 2018 forecast, georeferenced information's are becoming increasingly critical, both as macro location and as micro-location. Data visualization through maps, schema or vectorial pictures will be a more and more requested feature for a business analytics tool.

Business Localization and Graphical Exploration with Knowage LI

Knowage is the open source suite for business analytics that combines traditional and big data sources into valuable and meaningful information. Easy and intuitive interface, as well as meta-models and profiling, makes Knowage a modern BI solution. Knowage suite provides different products, each one focused on a specific domain but mutually combinable to build a tailored product for each analytical scope. Knowage **Location Intelligence (LI)** is the module that allows the user to plot business data over a map, a schema, a vectorial picture, producing immediate insights with mash-up techniques and not being forced to move data between GIS

About Author



Emanuele Ristatore
Consultant and Developer
Knowage
Email: emanuele.ristatore@eng.it



Elena Marchisa
Marketing and Communications
Knowage
Email: elena.marchisa@eng.it

and DWH environments.

Technically speaking, the Location Intelligence bounds geometries (dots, lines, polygons, solids) to equivalent points on Earth, using a coordinates reference system including, but not limited to, latitude and longitude.

Location: Geometries can be described using files (e.g. shapefiles or geojson) or a database: such geometrical information is easy to retrieve thanks to Open Data availability. The next step is the transformation of this information into easily understandable, like an image. Setting a source and a reference system, products like GeoServer can create the image that represents the desired geospatial data: Knowage LI uses this image to build its own map layers.

Intelligence: Knowage LI can easily bind datasets and layers, modifying geometries attributes (e.g. colour) according to the value of the related measures. The services Knowage LI can connect to our WMS, WFS and TMS that, being part of a standard, are independent of the publisher. Once the connection is created and saved in a layer, the service can be queried to get only the needed information. For example, on a layer with all the countries boundaries, setting a filter over the "continent" attribute allows to display only the European boundaries and their related measures.

From a functional point of view, performing Location Intelligence analysis with Knowage is really intuitive for the business user. He can customize map look&feel, choosing indicators, layers and formats. He can navigate the map, performing geographical selection and filters, and calculate distances. For instance, a user can correlate the area of various US States imported via geojson to one or more measures and choose whether he wants to display them through a colour gradient (single measure) based

on quantiles/even distribution or a simple bar graph (multiple measures).

Finally, within Knowage suite is possible to relate different types of analysis and show them in a single view. Through dashboards, in fact, a map can be bounded to a chart or a report and any selection made on one of these analysis will affect all the others.

Air Traffic Evaluation with Knowage LI

A very interesting application of Knowage LI capabilities is the AIDA project. This project, started in May 2015, has been required by the Italian air navigation service provider (ENAV) to analyze and optimize the air traffic flow over the Italian airspace and carrying out the operational performance monitoring.

Being the "flight object" (FO) the center of analysis, all the measures are FO-related. The database used for this project is Oracle DB, with spatial option, used to query and filter georeferenced data. The amount of data from heterogeneous sources has been a challenge, both to normalize and to manage. From different "dashboards" is now possible to navigate through the data to a specific flight, the causes of its delay, the reasons behind its flown route, etc.

Within seconds, a single flight out of 1.8 million flown every year, can be found and the LI component shows a map with the three routes (and the specific points) of that single FO:

- **Planned route:** the one passing through several FIX points along the sky highways, also known as airways;
- **Actual route:** the real trajectory that the flight has flown, made true through the frequent surveillance systems' pieces of information;
- **Actualized route:** the aircraft position derived from the surveillance systems snapped to the closest FIX points.

The huge amount of points and trajectories made mandatory the use of a GeoServer, publishing a different layer for each geometry in WMS EPSG:4326, Knowage LI then takes those layers to build a map, with trajectories and points, and all their attributes. Importing each time all those data, would have been pretty heavy, so Knowage LI filters them by itself, sending a query to the GeoServer with the mandatory parameters to retrieve the geometries of the right flights.

The reporting includes many maps, some stand-alone, others integrated in composite documents that control the trajectories shown. For example,

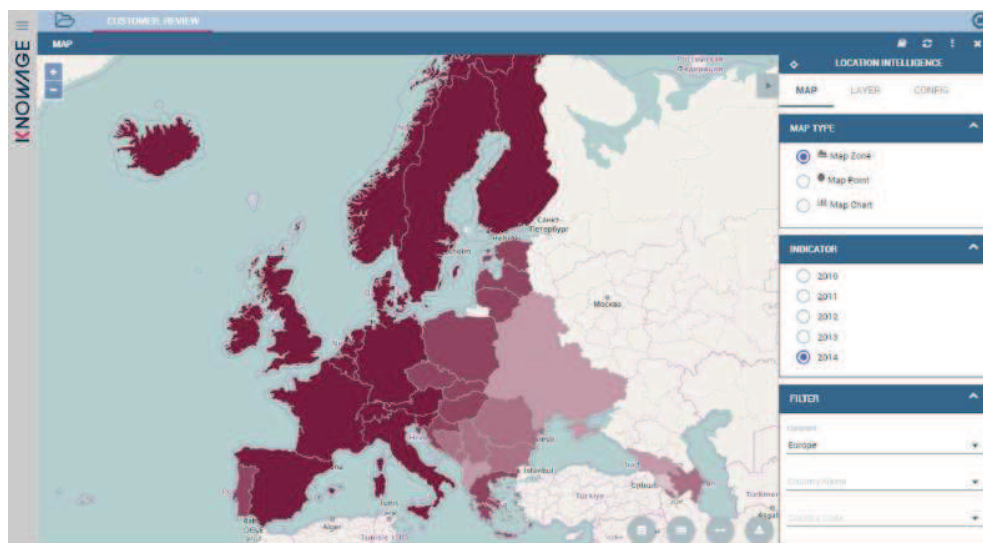


Figure 1. End user can easily modify the map and interact with it, choosing the right indicators and visualization options

selecting a specific flight from a list showing the 10 slowest flight for a city-pair, the map refreshes showing its three trajectories, giving potential useful information at a glance.

Most of the metrics in a current period are compared with historical values, up to ten years in the past. Those metrics include, but are not limited to:

- Airspace capacity (number of flight in a time span that passed through the Italian airspace)
- Airspace efficiency (number and weight of the deviations from the average flight time and distance for a city-pair)
- FO flight time and duration
- FO route analysis (vertical and horizontal)

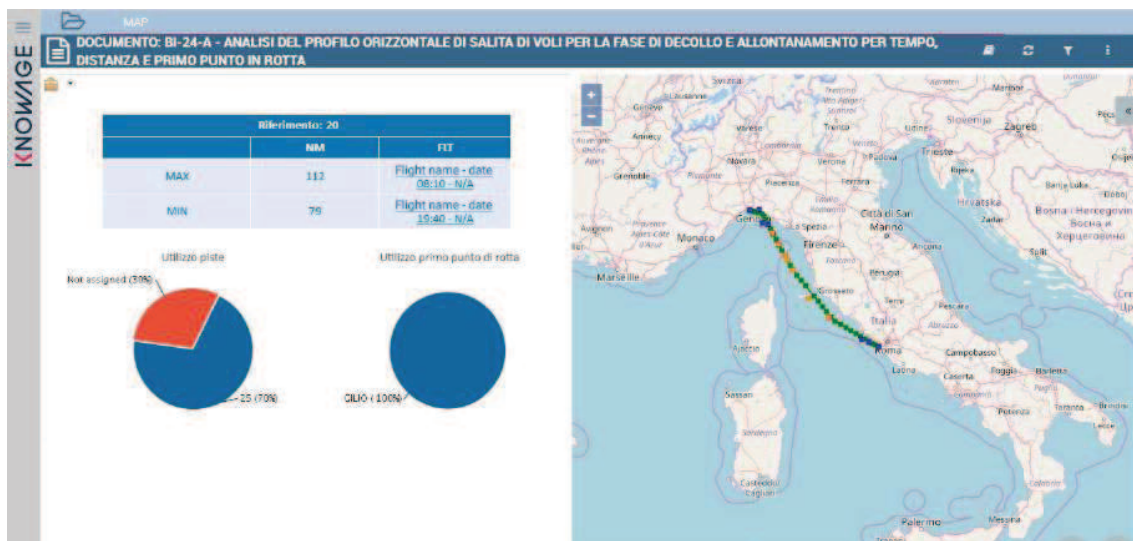


Figure 2. A map can be shown with other documents, using them as drivers to pick the correct geometry

- Airport hierarchization and PIs (e.g. average taxi time)
- Analysis of events that could have changed the average flight time (e.g. NOTAM)

Open Source Commitment

Knowage, the open source suite for business analytics, can be freely downloaded from Knowage website

and used in compliance with Affero GPL v3 licence with no restrictions. Knowage source code is available on GitHub, benefitting from the contribution of a wide open source community. Support over Knowage is freely provided by the community itself or through the professional services offered by Knowage Labs. For more information visit: www.knowage-suite.com

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